

Reproduction of the Clingfish, *Gobiesox strumosus*

ROBERT A. MARTIN AND CATHARINE L. MARTIN

THE early development of the clingfish, *Gobiesox strumosus* Cope, was studied in some detail by Runyan (1962), but data concerning reproductive behavior, successive spawnings, and possible reproductive potential, were not included. Comparative figures are lacking on the developmental rate of embryos under differing conditions.

MATERIALS AND METHODS

The breeding pair (male 69 mm, female 41 mm SL) were collected with a hand net on a concrete groin at 1400 Gulf Blvd., Madeira Beach, Florida. The initial spawning occurred in a 30 gallon plexiglass community tank on September 25, 1966. Eggs were attached in an oval cluster on the wall facing the laboratory window. An estimated 30 eggs were eaten by other fishes before parents and eggs could be segregated from them by inserting a glass partition. On September 27, a second clutch was attached next to the first.

After the second spawning, parents were transferred to a separate 20 gallon epoxy-plywood tank with submersible bone-charcoal filter and artificial breeding chamber. Spawning occurred in this tank on the following dates: 4 Oct. 1966, 20 Oct., 29-30 Oct., 7 Nov., 10 Nov., 17 Nov., 26 Nov., 30 Nov., 14 Dec. No attempt was made to raise the fry, though they survived 3-5 days after hatching. Eggs and embryos were examined live and subsequently preserved in a neutralized 10 per cent formalin solution for later reference.

The breeding chamber consisted of a 125 mm section of 50 mm PVC pipe cemented along the long axis to a rectangular base, and sealed at one end with a plastic disc. A single sheet of 125 × 75 mm photographic film cleared after exposure to light was inserted to line the roof of the breeding chamber. Eggs were subsequently attached to this sheet, which could be removed for examination without disturbing the male guardian. Small strips of film with attached eggs were trimmed from this sheet at regular intervals for inspection and preservation.

PRE-SPAWNING ACTIVITY

Events prior to the third spawning on October 4, 1966, passed through four distinct phases (1) exploration of the new tank and

breeding chamber by the pair, (2) adoption of the chamber by the male, (3) activity by the male to entice the female to this chamber, (4) acceptance of the male and his chosen site by the female. Both fishes made periodic explorations of their new tank which included two coral rocks, filter, and breeding chamber.

On the day prior to spawning, the male centered his activity in and about the breeding chamber, while the female tended to favor the aquarium wall closest to the laboratory window. By the following day the female tended to position herself much closer to the chamber on the same wall about 3 inches from the bottom. The male moved in and out of the chamber several times passing in static jerks upside down along the ceiling, then up over the rim, thus landing right side up on the roof where he faced his mate.

Though the female gave no obvious response to the male's display, he attached next to her on the wall and pressed close to her side. Both fishes faced the surface for a few seconds undulating their tails in unison with their genital papillae closely aligned, after which the male appeared to rotate his mate from her vertical position to one paralleling the bottom. When he returned to the spawning site the female followed. After the male had entered and left the breeding chamber the female entered alone, but when he attempted to join her, she quickly emerged. This avoidance pattern was repeated several times before the female remained with the male and spawning began.

SPAWNING ACTIVITY

The second spawning, which occurred while the pair was still in the plexiglass tank afforded the only opportunity to observe the details of egg deposition. The female faced upward during oviposition, and deposited the eggs from bottom to top in vertical rows attached to the wall of the tank. During the early stages of this activity the male vigorously undulated alongside the female, but later deserted her for increasing periods to pass over other parts of the growing egg mass. Both fishes rested for short periods during spawning. Milt was not observed.

Eggs were extruded individually at 2-5 second intervals during the period of observation which was from 1540-1650 hr. Approximately one-fourth of the eggs were deposited during this time. No infertile eggs were found in this mass.

TABLE 1

Developmental time, in hours, for eggs of *Gobiesox strumosus* reared at four different temperature ranges. Stages are those of Lagler, Bardach and Miller (1962)

Stage	Cluster 3*	Cluster 4	Cluster 8	Cluster 9
13			19	
14	24		24	
16			43	
17			51	
19	42	42		50
20		64	70	
22	67	72	94	98
24	72	91	99	98
26	92	96		
27			115	
28	120			
30			139	
31		113		122
32		120	163	174
33		162	187	
34		216	211	
35		258		
36		306		

*Cluster 3 (26.1-28.3C) cluster 4 (23.9-26.1C), cluster 8 (22.7-22.8C), cluster 9 (20-21.1C).

Spawning activity was confined to the daylight hours (0730-1900), with nine spawnings initiated between 1530 and 1830 hours. One egg mass (29-30 Oct.) was interrupted and not completed until the following morning. The breeding tank was not provided with special lighting, and ceiling lights were usually turned off by 1800 hours. Varying chemical and physical conditions were: pH 7.5-7.9; salinity 27-30 o/oo; water temperature 20-28.3 C.

Fertilization appeared to be complete in all cases. Five eggs did not hatch in batch 5 (29-30 Oct.) because of fungus. No more than two or three failed to hatch in each of the other clusters. One two-headed embryo almost reached the hatching stage in the tenth cluster (30 Nov.). Egg sizes agreed with those reported by Runyan (1962).

EGG TALLIES

The first two egg masses were tallied by means of marked photographs. Subsequent figures represent visual estimates based on

the size and density of the egg clutch. Tallies for eleven successive spawnings were: 1,126, 756, 350, 350, 700, 1,000, 300, 600, 600, 1,000, and 350. The conservative total is 7,100.

During the incubation period, the male guarded, regularly brushed and fanned the eggs, but showed no further interest after they hatched. The female took no part in egg care.

EARLY DEVELOPMENT

Hatching occurred in 5-7 days with eggs in the same clutch generally hatching within a 10 hr period. Time required for embryonic development tended to increase as water temperatures fell below 23.9 C. Numbers cited for developmental stages (Table 1) refer to those of Lagler et al. (1962) for *Fundulus heteroclitus*.

ACKNOWLEDGMENTS

Thanks are due Dr. John C. Briggs, University of South Florida; Dr. Frank J. Schwartz, University of North Carolina, and Mr. John H. Finucane, Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida for reviewing the manuscript.

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Curator, Seafloor Aquarium, P. O. Box 456, Nassau, New Providence Island, Bahama Islands.

Quart. Jour. Florida Acad. Sci. 33(4) 1970(1971)